It seems therefore that it is not by a chemical action, but by a peculiar dynamical influence that light produces contraction of the iris.

The power of the iris to contract when stimulated by light lasts extremely long, particularly in certain animals. In the eel I have found the muscular irritability of the iris, in one case, lasting *sixteen* days, during the last winter, in eyes taken out from the orbit. This is an interesting fact, not only on account of the long duration of vitality in the iris, but on account of the conclusion that we are entitled to draw from it, that muscular fibres may be stimulated without the intervention of nerves. In the iris of the eel the nerve-fibres are found very much altered a few days after the extirpation of the eye from the orbit, and they are almost destroyed twelve or fifteen days after this extirpation, *i. e.* at a time where muscular irritability is sometimes still existing.

III. A paper was in part read, entitled "Photo-chemical Researches.—Part I. On the Measurement of the Chemical Action of Light." By Professor BUNSEN of Heidelberg, and HENRY ENFIELD ROSCOE, B.A., Ph.D. Communicated by Professor STOKES, Sec. R.S. Received November 12, 1856.

November 27, 1856.

Sir BENJAMIN C. BRODIE, Bart., V.P., in the Chair.

Dr. Noad was admitted into the Society.

In accordance with the Statutes, notice was given of the ensuing Anniversary Meeting, and the following names of persons recommended for election as Council and Officers for the ensuing year, were announced from the Chair:—

President.—The Lord Wrottesley, M.A.

Treasurer.—Major-General Edward Sabine, R.A., D.C.L.

Secretaries.—William Sharpey, M.D.
George Gabriel Stokes, Esq., M.A., D.C.L.

Foreign Secretary.—William Hallows Miller, Esq., M.A.

Other Members of the Council.—James Moncrieff Arnott, Esq.; William Benjamin Carpenter, M.D.; Arthur Cayley, Esq.; The Very Rev. The Dean of Ely; William Fairbairn, Esq.; Arthur Farre, M.D.; William Robert Grove, Esq., M.A.; Joseph Dalton Hooker, M.D.; William Hopkins, Esq., M.A.; William Allen Miller, M.D.; Lyon Playfair, Esq., C.B., Ph.D.; Rev. Bartholomew Price, M.A.; Sir James Clark Ross, Capt. R.N., D.C.L.; Rear-Admiral W. H. Smyth, D.C.L.; John Stenhouse, LL.D.; John Tyndall, Esq., Ph.D.

Mr. Grove, Dr. Hooker, Mr. Hopkins, Sir James C. Ross, and Dr. Tyndall were elected Auditors of the Treasurer's Accounts on the part of the Society.

The reading of Professor Bunsen and Dr. Henry Roscoe's Paper "On the Measurement of the Chemical Action of Light," was resumed and concluded.

(Abstract.)

The only instrument which has been applied to the measurement of the chemical action of light was proposed in 1843 by Dr. Draper of New York. The sensitive substance employed by him was a mixture of chlorine and hydrogen, and by measuring the diminution ensuing on exposure to light, he experimentally determined some important relations of photo-chemical action. Draper's instrument is, however, not adapted for accurate measurements, owing, in the first place, to the fact that the gas is subject to varying pressure; and, in the second place, that the statical equilibrium, which must exist between the free and dissolved gases, in order that the free gas should consist of equal volumes of chlorine and hydrogen, was never approached.

In order to obtain more accurate results than was possible with Draper's tithonometer, we sought for means of preparing a gas containing equal volumes of chlorine and hydrogen; this means was found, notwithstanding Draper's contrary statement, in the electro-

lysis of strong aqueous hydrochloric acid. A series of volumetric analyses proved that the gas thus evolved consisted, as soon as the requisite saturation had been attained, of exactly equal volumes of its component parts, and did not contain the slightest trace of oxygen or oxides of chlorine. Another series of experiments with gas, similarly prepared, but allowed to stand before analysis for many hours in the dark in closed vessels, proved that, at the ordinary atmospheric temperature, the gases do not enter into combination when the light is excluded. Being thus enabled to prepare a substance which undergoes decomposition on exposure to light, but does not change on preservation in the dark, we proceeded to construct an apparatus by means of which the laws of the chemical action of light might be thoroughly investigated. After many fruitless attempts, we have succeeded in constructing an instrument, by which not only accurate comparative determinations can be made, but which has enabled us to reduce the chemical action of light to an absolute measure.

The most essential conditions fulfilled by our instrument are the following:—

1. A continuous evolution of a gas consisting of exactly equal volumes of chlorine and hydrogen free from all foreign impurities.

2. Constant pressure on the gas and liquids throughout the apparatus.

3. Absence of all caoutchouc or other organic matter which might alter the composition of the gas.

4. Exclusion of all variation in the composition of the gas in the apparatus from exposing the saturated liquids to the light.

5. Complete establishment of the statical equilibrium between the free and dissolved gases.

6. Elimination of the disturbing action of radiant heat.

The instrument in which these conditions are fulfilled is constructed entirely of glass, and consists essentially of four parts, viz.—1, a decomposing tube in which the gases are generated from carbon poles; 2, a washing tube containing water, furnished with an air-tight glass stopcock; 3, the vessel in which the gases are exposed to the action of the light attached to the other parts of the apparatus by air-tight ground-glass joints; and 4, a horizontal tube on which the diminution of volume in the insolation vessel is observed by means of a millimeter scale.

When the apparatus is freshly filled with the requisite quantity of water, the pure electrolytic gas is allowed to pass through, certain necessary precautions being used, until a constant source of light, such as a coal-gas flame burning under certain circumstances, produces in equal times always the same alteration of volume. This constant maximum action is generally not reached until from eight to ten litres of gas have passed through the instrument, and the saturation has continued for from three to six days. As soon, however, as this maximum is attained, the instrument is ready for use, and preserves this constant sensibility for many weeks, requiring only a short saturation each day in order to fit it for accurate photo-chemical measurements.

On exposing the gas to the light, the quantity of hydrochloric acid formed does not at once attain the maximum: a certain time often elapses before any alteration of volume is perceptible; a slight action is, however, soon observed, and this gradually increases until the permanent maximum is reached. This phenomenon, to which we have given the name of photo-chemical induction, is one of great interest and importance, and will be specially studied in our next section. As the maximum action is not attained for several minutes after the first exposure, the observations can only be made use of as soon as the action for several successive minutes has become constant. By a combination of several actual observations, the differences between the indications are found to be very slight.

Found.		Mean.		Diff.
13·23	....	13·36	....	+0·13
13·50	....	13·36	....	−0·14
13·35	....	13·36	....	+0·01

A special investigation was conducted for the purpose of determining the effect produced by the heat evolved from the slow combustion of the chlorine and hydrogen. Experiment and calculation gave the following as some of the more important results:—

1. That the heat evolved in the insolation vessel from the combustion of the gases exerts no perceptible influence on the indications of the instrument.

2. That the slight diminution in volume which occurs in the first few seconds after exclusion of light, is entirely owing to a decrease of temperature from a cessation of the combustion.

In order fully to test our apparatus, we have observed the action effected by a coal-gas flame of constant dimensions on our apparatus on different days. Determinations made in June last gave the following results:—

	Action in 1 min.	Diff. from mean.
11th June ..	14·00	+0·01
12th „ ..	14·26	+0·35
13th „ ..	13·80	−0·11
19th „ ..	13·83	−0·08
21st „ ..	13·88	−0·03
26th „ ..	13·72	−0·19
Mean value..	13·91	

Observations made with the constant flame placed at different known distances from the insolation vessel, proved that the amount of chemical action produced varied inversely as the square of the distance; and experiments made in September with the standard flame gave results which agreed most exactly with those obtained in June. From the exact agreement of these various observations we are assured of the accuracy and reliability of the measurements made with our instrument.

In order to see whether the variation of the atmospheric temperature exerted any influence on the sensibility of the electrolytic gas, we saturated the apparatus at various temperatures lying between 18° and 27° C., and found that the difference between the action at any two temperatures lying between the above degrees was so slight, that it did not exceed the unavoidable errors of experiment.

In the next communication we shall consider the relations of the interesting phenomena of photo-chemical induction.